

Risk Assessment of Brine Contamination to Aquatic Resources from Energy Development in the Williston Basin

Authors: Todd Preston, Brian Tangen, Tara Chesley-Preston, Joanna Thamke, Robert Gleason, Bruce Smith, and Rick Sojda

The Williston Basin of Montana, North Dakota, and South Dakota has been a leading domestic oil producing region for nearly half a century. Overlapping the Williston Basin is the Prairie Pothole Region (PPR), an area characterized by abundant wetlands that provide critical habitats for breeding and migrating waterfowl and other wildlife. Prior to enactment of regulations, highly saline coproduced waters (brines) associated with oil production were often disposed of using evaporation pits. Leachates have been shown to seep from these pits to groundwater, wetlands, and streams. In addition, other potential pathways exist for brines to enter the environment, including injection well failures, transport line breaks, and improper disposal methods. The migration of brines poses a great risk to the many species of wildlife and domestic livestock that are dependent on prairie wetlands and streams. Presently, the extent of contamination across the Williston Basin is unknown. As a result, there is great need for spatial information pertaining to oil production and aquatic resources, and science-based data describing the migration of brines through soils. Currently, an interdisciplinary team of U.S. Geological Survey researchers are conducting a study to assess the potential environmental impacts of oil production to wetlands in the Williston Basin, with special focus on the PPR.

This effort includes developing and obtaining spatial databases (e.g., wetland/well information, soils and geologic surveys) that will facilitate a spatial risk assessment with the purpose of 1) identifying areas containing high densities of wells and aquatic resources and 2) identifying aquatic resources that are in close proximity to wells or evaporation pits. In addition, two sites with a documented history of brine contamination in Montana and a new site in North Dakota were selected for detailed investigations to quantify the rate and extent of brine movement in the most common geologic deposits within the PPR (till, outwash, and lacustrine). Together, these efforts will produce products that will assist land managers and agencies such as the U.S. Fish and Wildlife Service to better allocate limited monitoring and mitigation resources to areas of greatest need and to better assess the risk posed to aquatic resources from brine contamination.